OBSERVATIONS ON THE *CHAROPIDÆ*.

Part I.

By C. Hedley, F.L.S.

(Plates I. and II.)

Widespread throughout Australia and Polynesia is a group of land shells which, varying greatly among its members, yet appears clearly distinguishable from other orders by the small size of its species, their cancellated sculpture, in which stout ribs are a prominent feature, flame painting, straight sharp peristome, which describes a convex then a concave sweep on approaching the right insertion, and a projecting semitransparent callus, which buries the sculpture of the whorl on which it encroaches. For this group I provisionally accept the title *Charopidæ*, assigned by Hutton, 1884 (Trans. N. Zealand Inst. xvi. p. 199), extending, however, the limits indicated by that writer. His vague diagnosis runs as follows: "Animal heliciform with an external shell; tail with a mucous gland." No type is nominated by the author of the family, and I therefore suggest that the type of *Charopidæ* would naturally be the genus *Charopa*, Albers, whose type species is *C. coma*, Gray. I quote from "Die Heliceen," 2nd ed. p. 87, the original definition of that genus.

Charopa, Albers (1860).

"Testa umbilicata, tenuis, depressa, raro conica, plicis transversis, elevatis, pilis rigidulis sparse saepissime obsilis, costulata; anfractus 4-5½, ultimus antice non descendens; apertura parum obliqua, lunato-rotundata; peristoma simplex, marginibus conniventibus."

Under this head he assembled these species :—*portia*, Gray ; *pinicola*, Pfr. ; *juloidea*, Forbes ; *eta*, Pfr. ; *ide*, Gray ; *varicosa*, Pfr. ; *epsilon*, Pfr. ; *coma*, Gray ; *anguiculus*, Reeve ; *gamma*, Pfr. ; *biconcava*, Pfr. ; *omicron*, Pfr. ; *zeta*, Pfr. ; *dimorpha*, Pfr. ; *hypopolia*, Pfr. ; *sericatula*, Pfr. ; *iota*, Pfr. ; *kappa*, Pfr. ; *egesta*, Gray ; *dianæ*, Pfr. ; *alpha*, Pfr. ; and *beta*, Pfr.

Considering the scanty material and information at the disposal of this sagacious naturalist, we may well admire his sketch of the affinities of this group, and regret that later writers have not followed the path indicated by the systematist of the last generation.

The only other reference to such a classification is the following remark by Pease (P.Z.S. 1871, p. 450), the fruits of an unrivalled knowledge and unremitting study of the land mollusca of Polynesia :—"Thirty-five or more species of *Helices* have been described from the Papuan Islands, Australia, Tasmania and New Zealand under the genera *Patula*, *Discus*, &c., which are more nearly related to the Polynesian genus *Pitys*. They are generally more planorboid in shape, with the aperture open and not laminate or dentate ; their relation to the genus *Pitys* cannot be determined until the animals are examined and compared."

From the same article, p. 451, I extract the characters of the genus *Pitys*, Beck, first defined in the "Index Molluscorum," 1837, and whose type is *P. oparica*, Anton, as amended by Pease.

PITYS, Beck (1837).

"Shell orbicular or planorboid, finely radiately ribbed ; spire but slightly elevated, last whorl rounded at its periphery and also at the umbilicus, more or less openly umbilicate, rarely imperforate ; aperture generally dentate or laminate ; radiately striped or tessellated on their upper surface with reddish-brown and yellowish, the stripes occasionally taking a zigzag form on the periphery and base ; rarely wholly reddish-brown ; generally covered with a thin epidermis, which, on a few species, supports short hairs."

"The above genus," observes Pease, "was established by Dr. Beck on *Helix oparica*, Anton, from the collection made by the late Mr. Cuming at the island of Rapa (Opara), one of the Austral group, a few hundred miles south of Tahiti. There is no doubt as to the identity of the species, although it was described by Dr. Anton as *H. oparica* from America. By reason of the similarity between the shells of certain species discovered since and those of the European genus *Discus*, Fitz., = *Patula*, Held., all the Polynesian forms have been described under the European genus; with few exceptions the shells are quite distinct and the animal decidedly so; they are most numerous at the Hawaiian and Tahitian Islands, less so at the Samoas, and altogether absent in West Polynesia."

Nevill (Hand List Mollusca, Indian Museum, Pt. I. p. 69) misquotes *H. contorta* as the type of *Pitys*.

Allied to *Pitys* is the genus *Endodonta*, Albers, type *E. lamellosa*, Férussac, created for the reception of species from the Society and Sandwich Archipelagos. The description, "Die Heliceen," 2nd ed. p. 90, runs as follows :—

ENDODONTA, Albers (1850).

"Testa umbilicata vel perforata, depressa, discoidea vel orbiculato-convexa; anfractus 5-8 arcte voluti; apertura rotundato-lunaris vel saepius angulata, rarissime simplex, plurumque in pariete ventrali lamellata, vel etiam margine basali lamellato-dentato, peristoma rectum, acutum."

Nearly related to the preceding is the genus *Libera*, Garrett. No type is named, but the first species, which may be considered such, is *L. fratercula*, Pease.

This genus was defined by Garrett (Journ. Acad. Nat. Sci. Philadelphia, Ser. 2, 1881, p. 390) in the following terms :—

LIBERA, Garrett (1881).

"Shell small, widely umbilicated, umbilicus (in adults) strongly constricted so as to form a cavernous or pouch-like cavity; whorls 7-9, costulate or striate, last one angulate or carinate, rarely

rounded; aperture subrhomboidal or securiform; peristome thin, simple, straight; parietal region with one or two, and the palate with (rarely without) two or three, internal laminæ; columella emarginate and furnished with a spiral fold."

Another genus which, judged by shell characters, would be assigned to the *Charopidæ* is *Diplomphalus*, Crosse and Fischer (1872), described Journ. de Conch. xx. p. 288, type *D. cabriti*, Gassies. The anatomy of this form as elucidated by Fischer (Journ. de Conch. xxi. pp. 1-25, pl. III.) demands for it, on the contrary, a position among the *Testacellidæ*. Fischer suggests (*op. cit.* p. 13), that various members of the *Testacellidæ* represent different groups of the *Helicidæ*, just as sundry orders of monodelphous mammals are shadowed forth among marsupials. We might pursue the idea further and inquire whether the *Testacellidæ* may not be an artificial group composed of forms of diverse origin which have independently acquired similar secondary characteristics consequent on adopting carnivorous habits. If *Diplomphalus* possesses a caudal mucous gland and pedal groove, these would support the shell characters in claiming for it a derivation from some form allied to *Charopa*.

Under *Charopidæ*, Hutton ranges (Trans. N.Z. Inst. xvi. p. 200) these four genera :—

Gerontia, Hutton (1884).

"Shell depressed, widely umbilicated, striated; periphery rounded; whorls about five, slowly increasing; aperture oblique. Mantle included. Jaw smooth, striated."

First species (type ?) *G. pantherina*, Hutton.

Pyrrha, Hutton (1884).

"Shell thin, translucent, of $4\frac{1}{2}$-$5\frac{1}{2}$ regularly increasing whorls, subperforate. Animal heliciform, mantle subcentral, reflected over the peristome with an even margin; tail truncate, with a large papilla and mucous gland. Jaw with flat ribs. Marginal teeth broad, with several points."

First species (type ?) *P. cressida*, Hutton.

PSYRA, Hutton (1884).

"Shell imperforate or narrowly umbilicated, ribbed, periphery rounded, not hairy. Jaw and teeth as in *Charopa*."

First species (type ?) *P. dimorpha*, Pfeiffer.

THERASIA, Hutton (1884).

"Shell conoidal, depressed, periphery subcarinated, subperforate or narrowly perforate, whorls smooth, striated or with membranous plaits. Jaw with flat ribs. Marginal teeth broad, usually with several points."

First species (type ?) *T. celinde*, Gray.

Seeing that the type of THALASSIA is *subrugata*, Pfeiffer, I must decline for the present to follow Hutton in classing it *(op. cit.* p. 203) among the *Charopidæ*.

Possibly Gray's genus LAOMA (1849), type *L. leimonias*, Gray, may be inserted in the family under discussion, but it does not share the ordinary appearance of its members.

Probably these two genera may also be included :—

THERA, Hutton (1884).

"Animal and jaw as in *Patula*. Shell conical, high, perforate, hairy ; periphery angled" *(op. cit.* p. 193).

First species (type ?) *T. alpha*, Pfeiffer.

PHACUSSA, Hutton (1884).

"Shell depressed ; periphery rounded ; whorls 5-6, gradually increasing. Mantle included. Jaw with flat ribs" *(op. cit.* p. 205).

First species (type ?) *P. hypopolia*, Pfeiffer.

Suter proposed, but did not formulate, a group (genus ?)—MAORIANA, Trans. N.Z. Inst. 1890, p. 96—to replace *Huttonella* (preoccupied) and to comprehend *leioda*, Hutton ; *pseudoleioda*, Suter ; *wairarapa*, Suter ; *hectori*, Suter ; *microundulata*, Suter ; and *aorangi*, Suter. He also quoted *(op. cit.* p. 90) SIMPLICARIA, Mousson, as a MS. generic term. Dr. von Martens has proposed

"Critical List of the Mollusca of New Zealand," 1873, p. 12, the group (genus ?) FLAMMULINA whose first species (type ?) is *H. omega*, Pfr.

From the above review of the genera proposed, it will be seen that the student of the *Charopidæ* is better supplied with divisional names than with definitions.

The following authors have written upon the dentition of the *Charopidæ** :—

Binney, W. G. : Proc. Acad. Nat. Sci. Philad. 1875, p. 248, *tumuloides*, Garrett, and *astur*, Souv. ; Annals of the New York Academy of Sciences, Vol. iii. pp. 88 and 89, *incerta*, Mousson, *tumuloides*, Garrett, *huahinensis*, Pfr., and *astur*, Souverbie.

Hutton : Trans. N.Z. Inst. xvi. pp. 161-182, *iota*, Pfr. ; *dimorpha*, Pfr. ; *celinde*, Gray ; *coma*, Gray ; *lucetta*, Hutton ; *gamma*, Pfr. ; *theta*, Pfr. ? ; *ide*, Gray ; *eta*, Pfr. ; *zeta*, Pfr. ; *lambda*, Pfr. ; *tapirina*, Hutton ; *portia*, Gray ; *venulata*, Pfr. ; *pantherina*, Hutton ; *epsilon*, Pfr. ; *pumila*, Hutton ; *alpha*, Pfr. ; *helmsi*, Hutton ; *fulminata*, Hutton ; *planulata*, Hutton ; and *thaisa*, Hutton.

Suter : Trans. N.Z. Inst. 1890, pp. 85-91, *mutabilis*, Suter ; *sterkiana*, Suter ; *brouni*, Suter ; *serpentinula*, Suter ; *bianca*, Hutton ; *cryptobidens*, Suter ; and *godeti*, Suter.

Semper : Reis. im Philip. iii. pl. II. f. 18, *bursatella*.

Hedley : Records Aust. Museum, i. p. 139, *whiteleggei*, Brazier.

Though it seems a bold assertion, I consider that no other group of land shells is to-day so imperfectly understood, so misrepresented in standard works, and so inefficiently figured and described. Pfeiffer in his last volume of the "Heliceorum Viventium" scatters broadcast among different sections the species I wish to assemble under *Charopidæ*. Of these forms Fischer (Manuel, p. 470) only mentions *Endodonta* to associate it with *Discus*, *Trochomorpha*, &c. Hutton (*op. cit.* p. 200) recognises the genus *Charopa*, yet on p. 191 he tears away from it the type *coma*, a proceeding not

* The writer does not possess the opportunity of assuring himself by personal inspection that all these species are correctly referred here.

justifiable by any rule of zoology, but one in which he is followed by Tryon. On turning to p. 17 of Tryon's Manual, 2nd Series, Vol. iii., the negligence with which this group is treated is at once apparent; *Charopa* and *Pitys*, though, as Pease remarks, doubtfully distinct, are sundered into different families; the type of *Endodonta* is misquoted as *huahinensis; Pitys* is wrongly fathered upon the brothers Adams and misdated 1855, while no intimation is given of the preoccupation of *Libera*, pointed out in Zoological Record, 1881, Index, p. 8. So many errors upon a single page sufficiently destroy our confidence in the treatment of the group by this monographer.

To summarise: I would consider that "*Patula*" has no existence in the Pacific; that the southern species usually referred to that genus are not even of the *Helicidæ* family; that these species can most conveniently be referred to one or other of the genera enumerated above, which genera may be grouped under the subfamily *Charopidæ*, a division of the family *Zonitidæ*.

None of the recorded descriptions fulfilling the exacting requirements of modern malacology, I propose in this and subsequent communications to refigure and redescribe all the Australian *Charopidæ* of which I can obtain authentic specimens. Having studied the material accessible to me, I shall then consider the value of the proposed generic divisions; provisionally, all will be quoted as "*Charopa*."

The following descriptions and accompanying figures are based upon the author's types, most kindly placed at my disposal for that purpose by my friend Lieut. C. E. Beddome, R.N., of Hobart, Tasmania.

Charopa albanensis, Cox (1867).

(Plate II. figs. 5, 6, 7, 8.)

Syn.—*eastbournensis*, Beddome and Petterd, MSS.

Illus.—Monograph Australian Land Shells, pl. iv. fig. 2 (2 figures); Manual of Conchology (2), ii. pl. lxii. figs. 25 and 26 (copied from the above).

Descr^{n}.—P.Z.S. 1867, p. 723; Mon. Aust. L. Shells, p. 15; Monographia Heliceorum Viventium, vii. p. 138; Man. Conch. (2), ii. p. 209; Trans. N.Z. Inst. xxiii. (1890), p. 85.

Shell thin, transparent; contour sublenticular, apex obtuse. Colour hyaline-white, painted above and below with very faint radiating chestnut flames, each extending over three costæ and narrower than the colour interspace, about 17 of these ornament the last whorl. Whorls $4\frac{1}{2}$, gradually increasing in diameter, upper whorls deeply channelled at their superior suture, somewhat flattened below and descending tumidly to the inferior suture, last whorl not descending at the aperture, channelled at the suture, flattened between the suture and the periphery, rounded abruptly at the periphery and gently on the base. Sculpture: the embryonic surface is modelled upon that of the adult and consists of faint capillary costæ, which become sharper and stouter as the growth proceeds, on the completion of a whorl and a-half the adult sculpture is abruptly substituted for the embryonic; the costæ here suddenly change to four times the size of their predecessors, with corresponding increase of the width of their interstices, in proportion as the shell increases so the intercostal spaces widen, their width is not always uniform nor are the costæ always of uniform size, more rarely they are not parallel, never do they continue across the suture from whorl to whorl, on starting from the suture the latest costæ are seen as sharp erect lamellæ directed square across the whorl, nearing the periphery they trend obliquely backwards, their upright crest curling backwards, arrived beneath the periphery they steer straight across the base to the rim of the umbilical crater, into which they plunge directly, viewed edgeways (the apex of the shell uppermost) each costa is somewhat the shape of a letter S whose upper bend has been straightened; upon the last whorl I counted 83 and upon the penultimate 60 costæ; between and parallel to the costæ are from four to twelve microscopic raised hair-lines, which are crossed at right angles by similar spiral lines; this secondary sculpture, which also extends over the costæ, gives an appearance of network to the shell when highly magnified, here and there a hair-line thickens into a rudimentary

costa. Umbilicus about a third of the width of the shell, deep, conical, showing every revolution and almost all the embryonic whorl, sculptured within similar to the spire. Aperture slightly oblique, ovate, lunate; peristome sharp, straight, except at the columellar margin, where it is a little reflexed, viewed from above the peristome describes a wide convex, then a sharper concave curve on approaching the insertion. Callus on body whorl slightly projecting past an imaginary straight line drawn from insertion to insertion of the peristome, thin, transparent, just burying the costæ overtaken by it. Diam. maj. $4\frac{1}{2}$, min. 4, alt. $2\frac{1}{2}$ mm.

Type in the Cox Collection.

Hab.—Port Albany, West Australia (Masters); Eastbourne, near Avoca, Tasmania (Beddome).

var. *stanleyensis*, Petterd (1879).

Syn.—*petterdiana*, Taylor (1879).

Descr^{n}.—Monograph Land Shells of Tasmania, p. 32; Quarterly Journal of Conchology, ii. (1879), p. 287; Trans. Roy. Soc. S.A. Vol. iv. p. 75.

Differs from the type by being more depressed, spire plane or nearly so.

Type in the Hobart Museum.

Hab.—Circular Head, Table Cape, Emu Bay, Torquay, Launceston, and Mount Wellington, Tasmania; islands in Bass Straits; Fernshaw (Petterd) and Gippsland (Australian Museum), Victoria.

var. *albida*, Taylor (1879).

Journ. of Conch. ii. p. 287.

"White, without markings" (J. W. T.).

Type (?).

Hab.—(?).

Specimens on which the above description is based, being the types of *eastbournenis*, exactly coincide with some of the original lot collected by Masters in West Australia. From both, specimens of *stanleyensis*, collected at Circular Head and sent by Petterd, differ in a varietal degree. My experienced colleague and friend

Mr. Brazier, who examined these specimens at my request, fully concurs with me in this opinion.

The extended range we thus find possessed by *albanensis* is shared by its congener *C. paradoxa*, Cox, and as our knowledge of the fauna of South-Western and South-Eastern Australia improves, so may the affinity demonstrated by Hooker between their respective floras be paralleled in the animal kingdom.

These shells offer another illustration of the law pointed out by Garrett*—that the most widely diffused species of land mollusca are always minute; other instances are—*Pupa pacifica*, Pfeiffer, in Australia; *Stenogyra gracilis*, Hutton, and *Pupa pedicula*, Shuttleworth, in Polynesia; *Vallonia pulchella*, Müller; *Vertigo muscorum*, Linné; *Zonites fulvus*, Draparnaud; *Z. viridulus*, Menke; *Z. nitidus*, Müller; *Acanthinula harpa*, Say; and *Ferussacia subcylindrica*, Linné, which range through the northern portions of Europe, Asia, and America.

C. antialba, Beddome (1879).

(Plate I. figs. 5, 6, 7, 8.)

Descr.—Monograph of the Land Shells of Tasmania, p. 41; Proc. Roy. Soc. Tasmania, 1879, p. 23; Trans. N.Z. Inst. xxii. 1889, p. 226.

Shell thin, transparent; contour, a sphere truncated at the poles, deeply concave above and below, the umbilical excavation deepest. Colour brown, the shade of dry dead leaves, streaks of slightly lighter shade represent the flame painting of other species. Whorls 5, the earlier enrolled within the later and almost concealed by them. From the channelled suture the last whorl rises perpendicularly, then arches outwards to its summit, from which it describes a curve of a third of a circle to its base, whence it incurves to the umbilical crater. The characteristic involute growth does not occur till the shell has attained a whorl and a half, at which point the embryonic sculpture is interrupted (as

* Journ. Acad. Nat. Sci. Philad. 1881, p. 396.

described in *albanensis)* by the adult and the shell at once commences to widen axially ; viewed either from above or beneath, the smoother plane embryonic shell is seen as the flat floor of the spiral or umbilical pit. Sculpture : the last whorl is adorned with 150 sharp erect straight costæ, which are seen to stand out in profile on the periphery like the teeth of a circular saw, they are directed straight across the whorl from the spiral to the umbilical sutures and may be likened to the lines of longitude on a terrestrial globe. The secondary sculpture varies upon different parts of the shell, that sketched in the accompanying illustration is selected from the umbilical wall of the last revolution. Upon the spire two or three raised hair-lines parallel to the costæ occupy the intercostal spaces, at right angles similar hair-lines cross both these and the costæ, producing a reticulated appearance. Towards the periphery these spiral lines grow faint, while the intercostal lines multiply to half-a-dozen, within the umbilicus the transverse lines diminish and the spiral sculpture assumes the supremacy. Umbilicus cup-shaped, profound, exposing every revolution, a third of the shell's diameter in width. Aperture perpendicular, crescentic, peristome straight, sharp, scarcely reflexed on the columellar margin, projecting at the periphery past an imaginary line drawn from insertion to insertion. Callus smooth, shining, thick, semitransparent, quite burying the overtaken costæ, projected on the penultimate whorl in advance of the peristome. Diam. maj. $2\frac{1}{2}$, min. $2\frac{1}{4}$, alt. $1\frac{1}{2}$ mm.

Type in the collection of C. E. Beddome, Esq., R.N.

Hab.—Gad's Hill and Mount Bischoff, Tasmania (Beddome) ; occurred under timber.

var. *alba*, var.nov.

Entirely hyaline-white.

Occurred with the above.

C. BISCHOFFENSIS, Beddome (1879).

(Plate I. figs. 1, 2, 3, 4.)

Descr^{n}.—Monograph of the Land Shells of Tasmania, p. 39 ; Proc. Roy. Soc. Tasmania, 1879, p. 23.

Shell thin, globose, slightly gibbous, very narrowly perforated. Colour brown, some specimens darker than others; the last whorl apparently darker than its predecessors. Whorls $5\frac{1}{2}$, slowly increasing, the penultimate wider than the final when seen from above, channelled at the suture, tumid beneath it; last whorl gradually and slightly ascending at the aperture, rounded at the periphery and on the base. Sculpture everywhere closely ornamented by microscopic transverse raised hair-lines, whose interstices are latticed by smaller spiral lines; upon the base there are distinguishable some thirty faint and irregularly spaced costæ, but this primary sculpture is obsolete above. Embryonic shell of $1\frac{1}{2}$ whorls, plane and nearly smooth, clearly marked off from the adult. Umbilicus very narrow, abrupt at the margin, half covered by a tongue of callus. Aperture crescentic, perpendicular, peristome thin, straight, projecting little at the periphery. Callus especially prominent and heavy, curving obliquely across the whorl. Diam. maj. $2\frac{1}{2}$, min. $2\frac{1}{4}$, alt. 2 mm.

Type in the collection of C. E. Beddome, Esq., R.N.

Hab.—Mt. Bischoff, Tasmania (Beddome); occurred under timber.

C. GADENSIS, Beddome (1879).

(Plate II. figs. 1, 2, 3, 4.)

Descr^{n}.—Monograph of the Land Shells of Tasmania, p. 29; Proc. Roy. Soc. of Tasmania, 1879, p. 23.

Shell thin, transparent; contour discoidal, spire plane. Colour hyaline-amber, unicolorous. Whorls $3\frac{1}{2}$, rather rapidly increasing, deeply channelled at the suture, rounded on their summits and at the periphery, flattened somewhat on the base. Sculpture: embryonic whorls, comprising the first $1\frac{1}{2}$ revolutions, delicately sculptured by faint transverse capillary costæ, the adult whorls are ornamented by fine capillary costæ, of which the last whorl bears about 175. These are directed straight across the whorl, and are everywhere crossed by very minute raised hair-lines, which within the umbilicus grow coarser and dominate the transverse lines. Umbilicus about a third of the diameter of

the base, deep, cup-shaped, margin rounded. Aperture slightly oblique, roundly lunate, peristome straight, sharp, projecting at the periphery, scarcely reflexed on the columellar margin. Callus projecting, bluish-white, thin, just burying the costæ of the preceding whorl. Diam. maj. 2, min. $1\frac{3}{4}$, alt. $\frac{3}{4}$ mm.

Type in the collection of C. E. Beddome, Esq., R.N.

Hab.—From Gad's Hill to Mt. Bischoff, Tasmania (Beddome); occurred in and under decayed timber.

EXPLANATION OF PLATES.

Plate I.

Figs. 1-3.—Lateral, superior, and inferior aspects of the shell of *C. bischoffensis*, Beddome. Magnified.

Fig. 4.—Sculpture of the same. Much magnified.

Figs. 5-7.—Lateral, superior, and inferior aspects of the shell of *C. antialba*, Beddome. Magnified.

Fig. 8.—Sculpture of the same. Much magnified.

Plate II.

Figs. 1-3.—Lateral, superior, and inferior aspects of the shell of *C. gadensis*, Beddome. Magnified.

Fig. 4.—Sculpture of the same. Much magnified.

Figs. 5-7.—Lateral, superior, and inferior aspects of the shell of *C. albanensis*, Cox. Magnified.

Fig. 8.—Sculpture of the same. Much magnified.